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Guttman et al.

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[45] **Aug. 20, 1974**

[54] **CLEANING PAINT HOOKS**

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[73] Assignee: **National Steel Corporation,** Pittsburgh, Pa.

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[21] Appl. No.: **176,564**

[52] **U.S. Cl.** **118/70,** 118/326, 134/63, 134/105, 198/229

[51] **Int. Cl.** **B05c 11/16**

[58] **Field of Search** 118/70, 17, 47, 326; 99/351; 134/63, 105, 19; 198/229, 231

[56] **References Cited**

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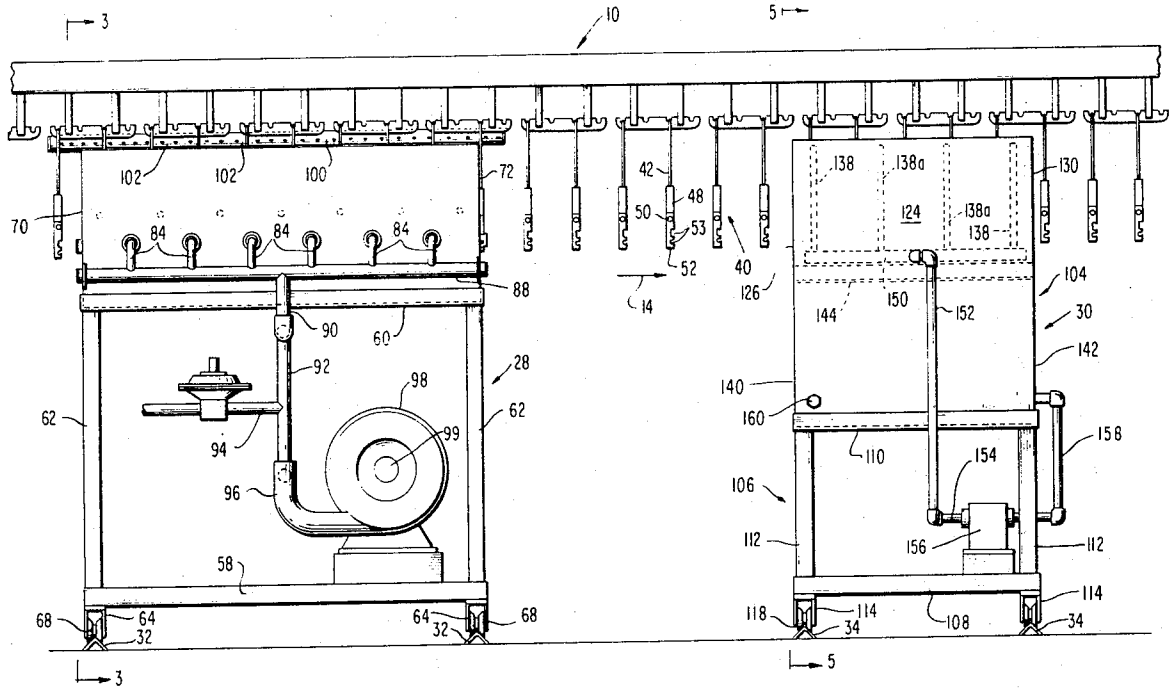
Attorney, Agent, or Firm—Shanley & O'Neil

[57] **ABSTRACT**

Hangers used to suspend articles (e.g., aluminum extrusions) from a conveyor for transport through a continuous painting line are cleaned of accumulated paint without stopping the conveyor by burning the paint to ash in an oven and spray washing to remove the ash.

12 Claims, 7 Drawing Figures



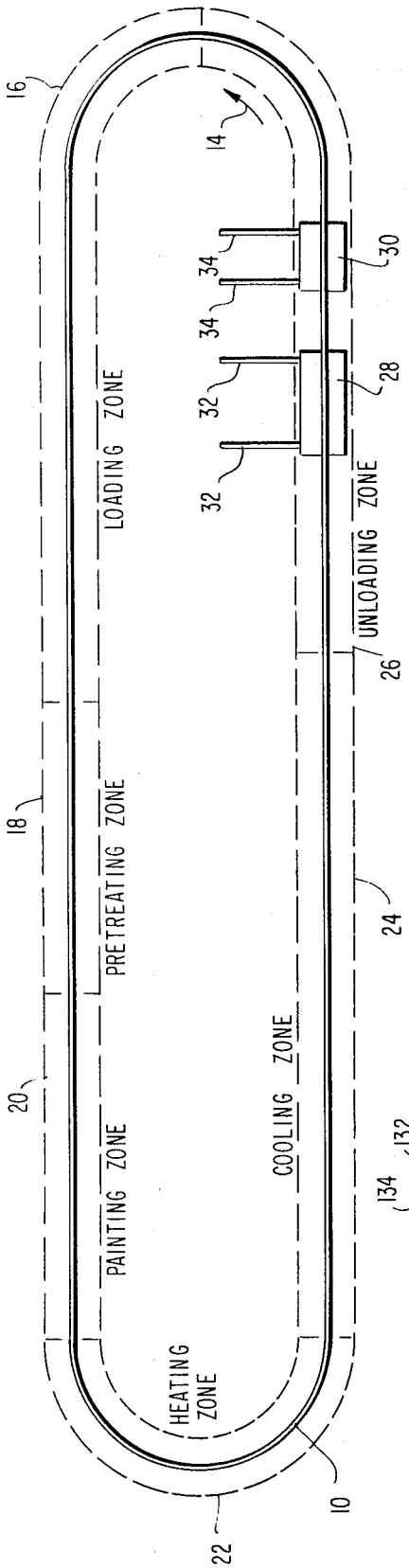


FIG. 1

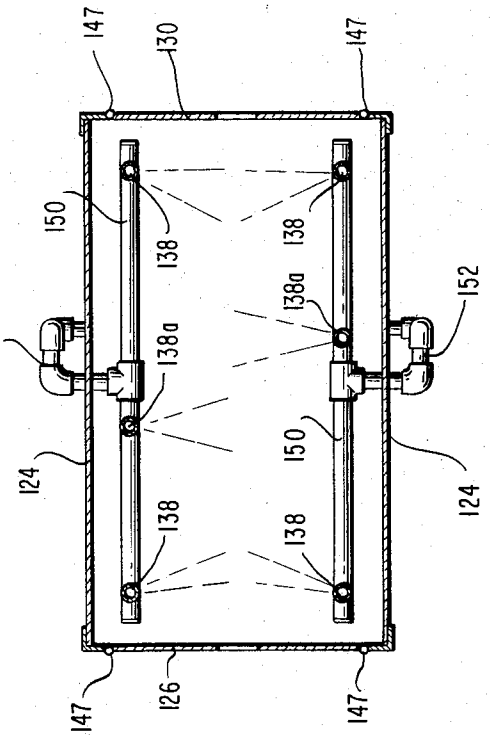


FIG. 7

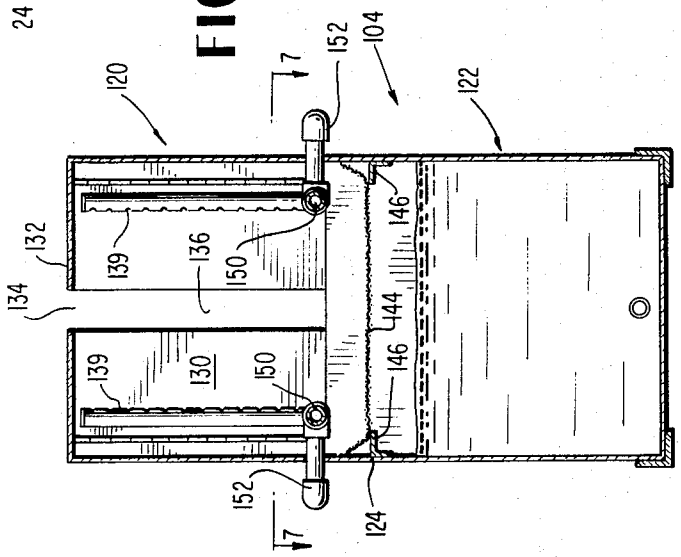
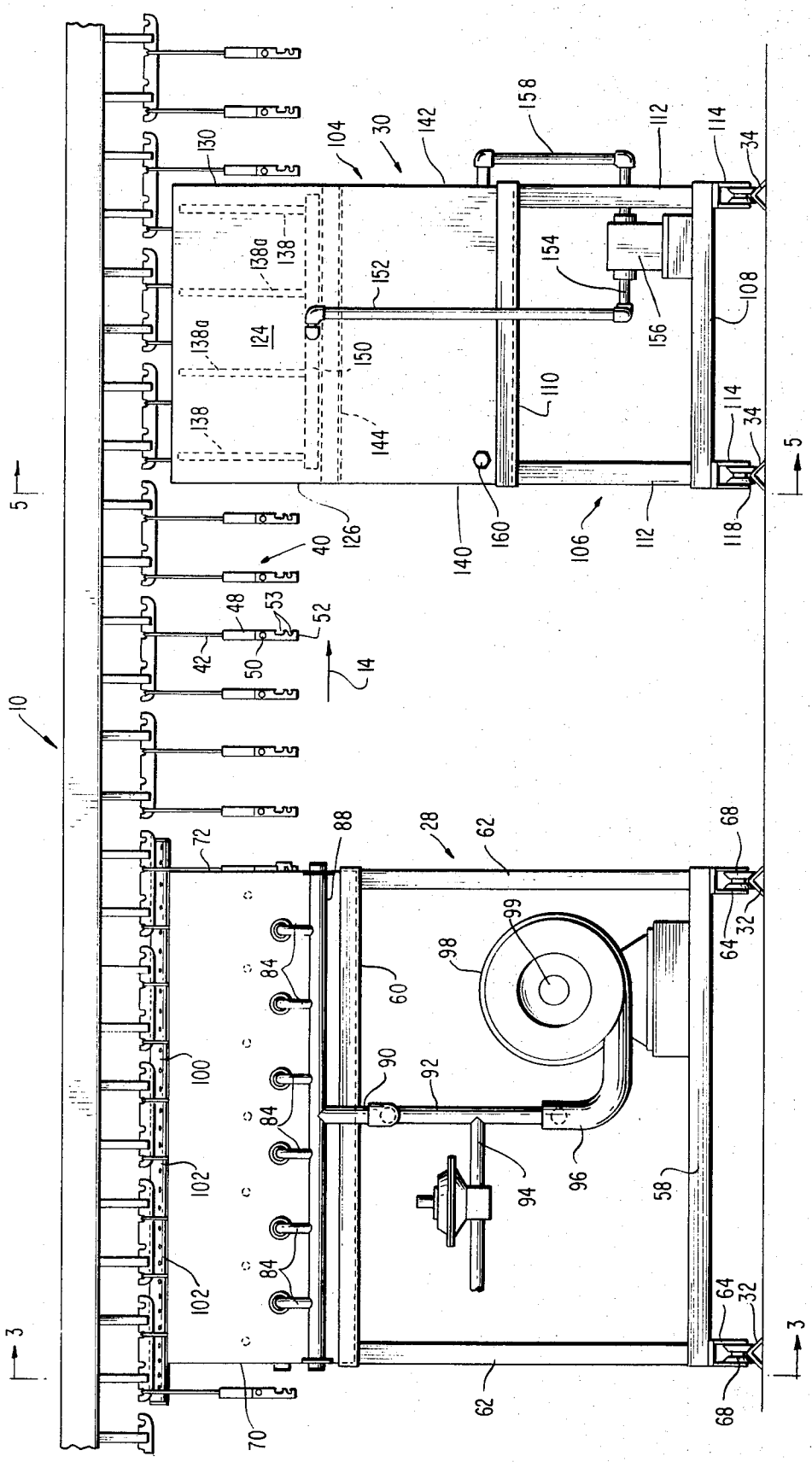


FIG. 6

FIG. 2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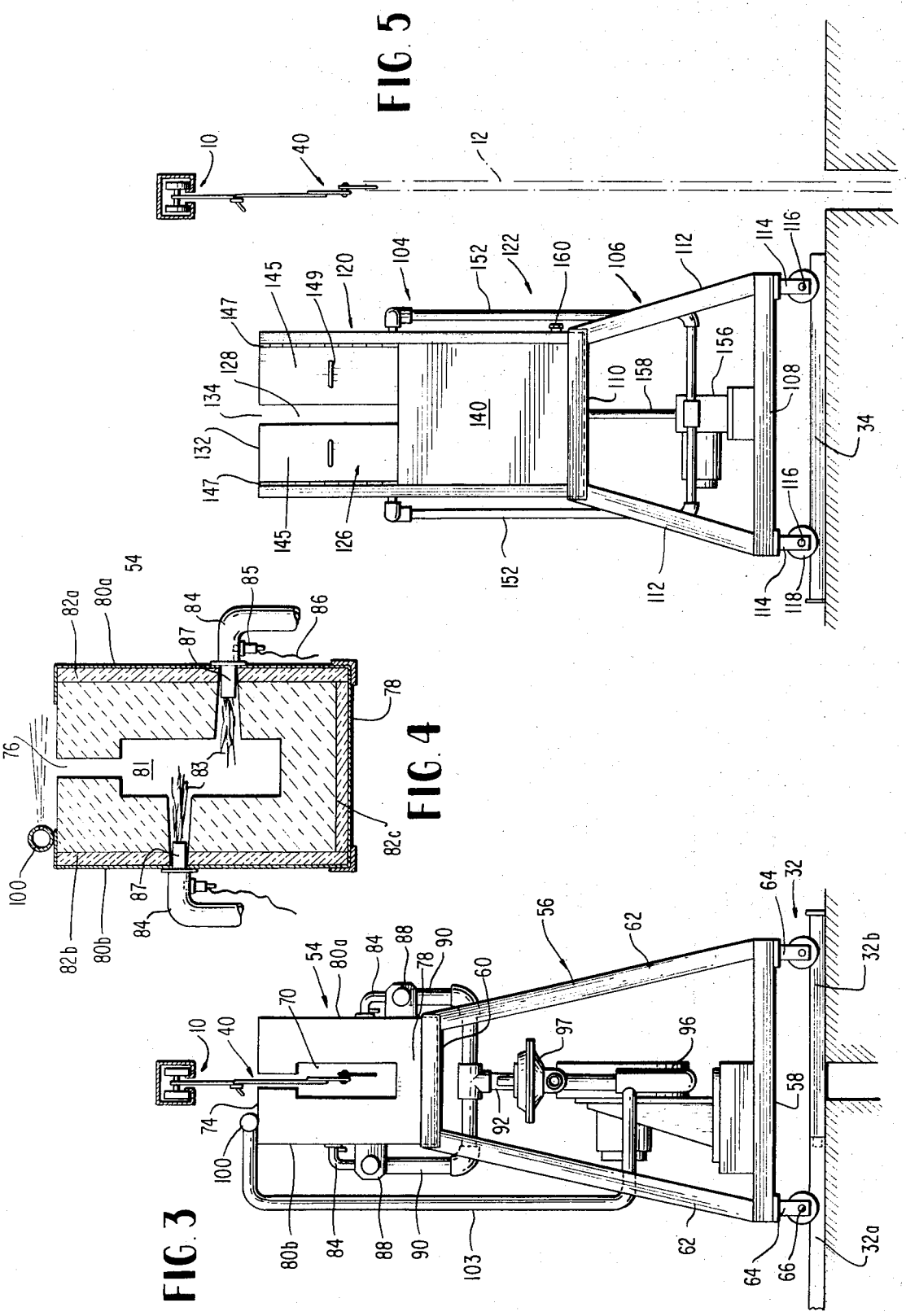
FIG. 5
FIG. 4
FIG. 3

CLEANING PAINT HOOKS

BACKGROUND OF THE INVENTION

This invention relates to a system for removing coating material accumulated on fixtures in a coating line. It is especially useful in conjunction with a conveyor line in which articles (e.g., aluminum extrusions used primarily for structural purposes) are painted electrostatically.

A continuous painting line typically includes an endless overhead conveyor from which articles undergoing painting and associated treatment are suspended. Carriers or hangers depending from the conveyor implement the suspension. Since the carriers repeatedly pass through a painting zone, they eventually would accumulate paint to the extent that the operation of the line would be interfered with if paint were not removed before it became a problem. In an electrostatic painting line, paint buildup on the carriers retards electrical current flow resulting in improper painting. If carriers are utilized having parts movable relative to each other such as those described in applicants' copending application Ser. No. 138,095, filed Apr. 28, 1971, now U.S. Pat. No. 3,744,449 paint buildup can interfere with such movement.

In general, the disadvantages of paint buildup on carriers is well recognized, and paint removal is carried out periodically in accord with good housekeeping principles to forestall interference with line operation. However, prior procedures for cleaning the carriers were very expensive, cumbersome, slow and difficult. Men removed the carriers from the conveyor and immersed them in a tank of solvent to dissolve the paint. The labor to take down the carriers was expensive. The solvents likewise were expensive and presented disposal and safety problems. The dissolving process required 4 to 5 hours; and since it is uneconomical to have the line shut down for that period of time, it was necessary to keep a spare complete set of carriers to put on line during cleaning.

The main object of this invention is to provide a faster, cheaper, more efficient way of cleaning the carriers.

Other objects and advantages of the invention will appear from the following detailed description, which, when considered in connection with the accompanying drawings, describes a preferred embodiment of the invention for purposes of illustration only and not for definition of the limits of the invention.

Brief Description of the Drawings

FIG. 1 schematically illustrates a continuous coating circuit and depicts the position in the sequence of operations of the subject cleaning system.

FIG. 2 is a side view depicting the general arrangement of structure embodying principles of the invention.

FIG. 3 is an end view on line 3—3 of FIG. 2 depicting structure in operating position.

FIG. 4 is a vertical sectional view depicting interior details of the structure of FIG. 3.

FIG. 5 is an end view on line 5—5 of FIG. 2 depicting structure in out-of-line position.

FIG. 6 is a vertical sectional view depicting interior details of the structure of FIG. 5.

FIG. 7 is a horizontal sectional view depicting interior details of the structure of FIG. 5.

Description of the Preferred Embodiment

In the continuous electrostatic painting line illustrated in FIG. 1, conveyor 10 carries articles in the form of aluminum extrusions (not shown) in a direction of travel indicated by directional arrow 14 through a series of zones. The sequence of zones includes a loading zone 16, a pretreatment zone 18, a painting zone 20, a heat-drying zone 22, a cooling zone 24 and an unloading zone 26. The location of the cleaning structure of this invention in terms of progress along the conveyor circuit is between the unloading and loading zones, 26 and 16, respectively. This cleaning structure comprises an oven 28 defining a burn-off zone followed by a spray washer 30 defining a washing zone. The oven 28 and washer 30 are mounted on tracks 32 and 34 respectively so that the oven and washer can be moved transversely of the direction of travel 14 into and out of the line. Although the structure can be left in the line at all times, it is highly preferred to move it out of the line when it is not in use to give more room for loading and unloading personnel to operate.

Referring to FIG. 2, the overhead conveyor 10 and depending carriers 40 are of the type described in detail in application Ser. No. 138,095 mentioned previously. In other words, the conveyor 10 is of the endless chain type traveling on wheels following an overhead track. Each carrier or article hanger 40 comprises a suspending wire 42, and a stabilizer plate 48 swingably connected by a pivot pin 50 to a gripper plate 52. The gripper plate 52 contains notches 53. Into one of these notches, an aluminum extrusion (not shown) undergoing treatment is jammed by action of gravity. The article hangers 40 accumulate paint and are cleaned by use of depicted structures 28 and 30.

Referring to FIGS. 2–4, the burn-off oven 28 comprises an elongated chamber 54 mounted on a frame 56.

Frame 56 has a generally rectangular horizontally oriented base 58, a generally rectangular horizontally oriented supporting plate 60 positioned above base 58, and upwardly and inwardly extending members 62 joining each corner of base 58 with a corresponding corner of supporting plate 60.

Extending downwardly from the lower surface of base 58 at each of its corners is a C-shaped wheel frame 64. Each frame 64 holds an axle 66 (FIG. 3) on which revolves a wheel 68. The wheels 68 ride on tracks 32 so that oven 28 can be moved out of the line when it is not in use. It is depicted in line position in FIG. 3. For accommodating benefits achieved by moving the oven in and out of the line, the tracks 32 are composed of permanent sections 32*a* and removable sections 32*b* so that the track can be made to stop short of the line or extend beyond it.

The elongated chamber 54 rests on and is attached to the upper surface of plate 60. It has an open entry end 70, an open exit end 72, a top wall 74 containing an opening 76 (FIG. 4) extending its length, a bottom wall 78 and sidewalls 80*a* and 80*b*. The openings and walls are dimensioned and relatively spaced to provide a passageway 81 for movement through the chamber 54 of the carriers 40 when the oven 28 is in line position.

Referring to FIG. 4, the bottom wall 78 and sidewalls 80*a* and 80*b* comprise respectively outer layers of heat insulation 82*c*, 82*a* and 82*b*.

Each of the sidewalls 80*a* and 80*b* contains a series of channels 83 which extend transversely therethrough and communicate with passageway 81. Each channel 83 diverges as it approaches passageway 81. A burner 84 is positioned in each channel 83. The channels 83 and thus the burners 84 in a sidewall 80*a* or 80*b* are horizontally aligned and equally spaced along the length of the sidewall. The channels 83 and their associated burners 84 in sidewall 80*a* are horizontally and downwardly offset from the channels 83 and their associated burners 84 in sidewall 80*b*.

Each burner 84 has associated therewith a spark plug 85 which is connected by a wire 86 to a source of electric power (not shown). It is positioned so that its outlet port 87 is adapted to discharge into its associated channel 83 and from there into passageway 81 transversely of the direction of movement 14 of the carriers 40. Each series of burners 84, that is the burners on each side of chamber 54 communicate at their upstream ends with a fuelair supply header 88 (FIGS. 2 and 3) which extends along the length of that side of chamber 54.

Each of the two headers 88 communicates by a conduit 90 to main fuel-air supply line 92 which in turn communicates with fuel gas supply line 94 and air supply line 96. Line 94 contains a gas regulator 97 and is flexibly attached to a source of gas (not shown). Air supply line 96 communicates with the discharge of blower 98 which has a centrally located ambient air intake 99. Blower 98 rests on the top surface of the base 58 of frame 56.

An elongated conduit 100 is positioned along the top surface of top wall 74 of chamber 54 beside opening 76. The conduit 100 extends beyond the ends 70 and 72 of chamber 54. It contains a multiplicity of orifices 102 adapted to direct a curtain of compressed air across opening 76 and also beyond the open ends of chamber 54. Air is supplied to conduit 100 by line 103 which in turn is supplied by line 96.

Referring to FIGS. 2, 5, 6 and 7, washer 30 comprises an elongated chamber 104 which is mounted on a frame 106.

Frame 106 comprises a generally rectangular horizontally oriented base member 108, a generally rectangular horizontally oriented supporting plate 110 positioned above base member 108, and upwardly and inwardly extending columns 112 joining each corner of member 108 with a corresponding corner of plate 110.

Depending downwardly from the lower surface of base member 108 at each corner is a C-shaped wheel frame 114, each carrying an axle 116 about which rotates a wheel 118. The wheels 118 ride on tracks 34 so that washer 30 can be moved out of the line when it is not in use. It is depicted in out-of-line position in FIG. 5. The phantom line 12 in FIG. 5 denotes the position of an aluminum extrusion as it is carried by a hanger 40 through the painting circuit and thus denotes the line position. When washer 30 is to be moved into the line, a section of track is joined to that depicted (FIG. 5) so that track 34 extends beyond the line as does track 32 depicted in FIG. 3.

The elongated chamber 104 rests on and is attached to the upper surface of plate 110. It has an upper portion 120 and a lower portion 122.

The chamber has sidewalls 124 which function as sidewalls both for upper portion 120 and for lower portion 122.

Upper portion 120 also has an entry endwall 126 containing a rectangular elongated opening 128 extending from its bottom edge to its top edge, an exit endwall 130 containing a similar opposite opening, a top wall 132 having an opening 134 extending its length and joining the openings in the endwalls 126 and 130, and an open bottom. The openings and walls are dimensioned and relatively spaced to provide a passageway 136 (FIG. 6) for movement of carriers 40 when washer 30 is in line position.

Within upper portion 120 extending upwardly adjacent each sidewall 124 are two nozzles 138 and one nozzle 138*a*. The three nozzles adjacent a sidewall are aligned and spaced from each other along the length of the sidewall so that one nozzle 138 is adjacent each of the endwalls 126 and 130 and the third nozzle 138*a* is between the other two (FIG. 7). Whereas an outer nozzle 138 adjacent one sidewall is opposite the corresponding outer nozzle 138 adjacent the other sidewall, the interior nozzles 138*a* are offset from one another. Each of the nozzles has a multiplicity of holes 139 (FIG. 6) drilled therein adapted to discharge liquid from the nozzle as spray transverse to the direction of travel 14 of the carriers 40 so as to impinge the liquid on the carriers.

Lower portion 122 in addition to having sidewalls formed by chamber sidewalls 124 has endwalls 140 and 142 (FIGS. 2 and 5), a bottom wall (not shown) forming the bottom of chamber 104 and an open top opposite the open bottom of upper portion 120. This lower portion 122 functions as a sump for receiving the liquid sprayed within the upper portion 120.

A reticulated member in the form of a screen 144 is interposed between upper portion 120 and lower portion 122. It rests within chamber 104 on angles 146 which are welded to the interior of sidewalls 124. Preferably the screen 144 has interstices each having a diameter of about one-eighth inch. Endwalls 126 and 130 each contain a pair of doors 145 hinged at 147 and openable along these hinges by pulling on handles 149 to expose screen 144 so that it can be removed for cleaning.

The nozzles 138 and 138*a* along a sidewall 124 communicate at their upstream ends with a horizontally oriented header 150 and the headers communicate with supply conduits 152 which in turn communicate with main supply conduit 154 (FIG. 2). Conduit 154 communicates with the discharge of recirculating pump 156. Pump 156 is supported on the upper surface of base 108. Return conduit 158 communicates at its downstream end with the suction of pump 156 and at its upstream end with the bottom part of lower portion 122 through endwall 142 (FIG. 2). One sidewall 124 contains a drain plug 160 which is removed to drain lower portion 122.

For use, the oven 28 and washer 30 are moved along tracks 32 and 34 (having their removable sections in place) into the line between the unloading zone 26 and loading zone 16 as depicted in FIG. 2.

The carriers (hangers) **40** are moved by conveyor **10** into open entry end **70** of oven **28** and progress through passageway **81** past the series of burners **84.**

Natural gas or other hydrocarbon containing combustible gas (e.g., propane) supplied through line **94** is admixed with air supplied by blower **98** and line **96,** and the mixture passes through line **92,** conduits **90** and supply headers **88** into the individual burners **84.** Ignition is carried out with spark plugs **85** at start-up; after that, the flame is self-propagating.

The flame and the hot gas resulting from the combustion emanate from ports **87** and are directed by channels **83** against the carriers (hangers) **40** during the movement of the carriers through passageway **81.** The diverging nature of each channel **83** provides for a larger area of coverage for each burner and accommodates expansion of gases as combustion proceeds.

The temperature in the oven is regulated so that with the line speed being utilized the paint accumulated on the carriers is burned off producing combustion product gas and leaving a solid residue of ash.

The combustion gas leaves chamber **54** through open ends **70** and **72** and through opening **76** in top wall **74.** Air supplied by blower **98** is passed from line **96,** through line **103** and conduit **100** and out of orifices **102** to provide a curtain of compressed air directed across opening **76** to shield overhead conveyor **10** from combustion gas emanating from that opening. The extension of conduit **100** beyond the ends **70** and **72** provides an air curtain shielding conveyor **10** from the hot combustion gases leaving these open ends.

The carriers (hangers) **40** now coated with ash residue are moved out of exit **72** of oven **28** and then into opening **128** in entry endwall **126** of washer **30.** They then progress along passageway **136** of the washer. In the washer, water passes via conduits **152** and headers **150** into nozzles **138** and **138***a* and is directed by orifices **139** as a spray impinging on the carriers to wash them to remove the residue and to cool the carriers by removing heat imparted to them in the oven **28.**

The removed ash is entrained in the water and this combination falls downwardly from upper portion **120** of chamber **104.** As the water passes through screen **144,** the ash is retained in the screen. The water cleaned of ash continues to fall into lower portion **122** of chamber **104** to provide a body of water in the lower portion for recirculating by pump **156** into conduit **154** and conduits **152.**

The carriers having been quickly and efficiently cleaned of accumulated paint and cooled without stopping of the conveyor then progress to zone **16** (FIG. 1) where aluminum extrusions are loaded for painting.

When the cleaning operation has been completed, the cleaning structures **28** and **30** are moved along tracks **32** and **34** respectively out of the line. The removable track extensions (**32***b* is depicted) are then removed so that the track will not interfere with extrusions **12** carried into the unloading zone **26.**

As a specific example, steel hangers in a continuous electrostatic painting line of the type described above and having the dimensions recited in the specific example in previously mentioned application Ser. No. 138,095 are treated in structure as described above to remove acrylic baked paint which has accumulated thereon as a result of repeated passages around the circuit.

The oven utilized has a chamber **54** which is 60 inches long, 16.5 inches high and 12 inches wide. Opening **76** is 1.5 inches wide. The temperature maintained in the oven by the burners ranges from 1,800° to 2,000° F.

The washer utilized has a chamber **104** which is 36 inches long and 21 inches wide. Each nozzle is 14 inches long and contains 12 holes each having a diameter of three-thirty seconds of an inch. The screen 144 has interstices with a diameter of 1/8 inch.

With a line speed of 10 feet per minute, excellent cleaning results are achieved.

Many other modifications of the preferred embodiment can be made without departing from the spirit of the invention.

For example, fixtures with coatings other than paint as well as fixtures coated or painted in other types of electric processes (e.g. electrophoretic processes) or nonelectric processes are advantageously treated with the structure described above as long as the coatings are burnable to form combustion product gas and solid residue. The cleaning structure can be suspended from overhead instead of supported from below. Instead of supplying heat with gas burners, other heat sources, for example, electrical heating can be used. If gas burners are utilized, other nozzle spacings can be utilized. The oven and washer instead of being independent units can be combined into a single unit.

Thus the scope of the invention is defined as set forth in the appended claims.

What is claimed is:

1. System for removing coating material accumulated on carriers depending from an overhead conveyor used to continuously move articles through a zone for applying coating to the articles, said system comprising,

an elongated chamber having an open entry end, an open exit end, a top wall having an opening extending its length, a bottom wall and sidewalls to provide a passageway for movement through the chamber of the carriers depending from the conveyor,

means associated with at least one of the sidewalls to burn accumulated coating material from the carriers in the course of such movement thereby producing combustion product gas and leaving a solid residue, and

means downstream of said sidewall associated means to impinge liquid on the carriers to remove the residue.

2. The system of claim **1** wherein the burning means are associated with each sidewall and comprises a series of burners each supplied with air and gaseous fuel.

3. The system of claim **2** wherein the burners associated with a sidewall are horizontally aligned and equally spaced along the length of the sidewall and each burner has a port adapted to discharge transversely of the direction of travel of the carriers.

4. The system of claim **3** wherein the burners in one sidewall are horizontally and vertically offset from the burners in the opposite sidewall.

5. The system of claim **1** wherein an elongated air conduit is positioned along the top surface of the top wall beside the opening in the top wall and this conduit contains a multiplicity of orifices adapted to direct a curtain of compressed air across the opening to shield the overhead conveyor from combustion gas.

6. The system of claim 5 wherein the air conduit extends beyond the ends of the elongated chamber.

7. The system of claim 1 wherein the chamber is movable transversely of the direction of travel of the carriers.

8. The system of claim 7 wherein the chamber is mounted on tracks for such movement.

9. System for removing coating material accumulated on carriers depending from an overhead conveyor used to continuously move articles through a coating line including a zone for applying coating to the articles, said system comprising

means for burning accumulated coating material from said carriers thereby producing combustion product gas and leaving a solid residue,

means downstream of said burning means to impinge liquid on the carriers to remove the residue, and

means associated with each of said means to move zones including each of said means transversely of the direction of travel of the carriers between in-line and out-of-line positions, thereby providing means to move said zones into the line for periodic removal of accumulated coating material and means to remove said zones from the line to minimize interference with coated article output.

10. The system of claim 9 wherein the means for transverse movement comprise tracks.

11. System for removing coating material accumulated on carriers depending from an overhead conveyor used to continuously move articles through a zone for applying coating to the articles, said system comprising

means for burning accumulated coating material from said carriers thereby producing combustion product gas and leaving a solid residue,

means downstream of said burning means to wash the residue from the carriers comprising

an upper portion having sidewalls, an entry endwall containing a rectangular elongated opening extending from its bottom edge to its top edge, an exit endwall containing a similar opposite opening, a top wall having an opening extending its length and joining the openings in the endwalls to provide a passageway for movement of the carriers depending from the conveyor, and an open bottom,

means within the upper portion to spray liquid transversely of the direction of travel of the carriers to impinge liquid on the carriers to remove residue therefrom,

a lower portion having an open top opposite the open bottom of the upper portion and functioning as a sump for receiving the liquid sprayed within the upper portion,

a reticulated member interposed between the upper portion and lower portion to screen residue from the wash liquid, and

means to recirculate liquid from the lower portion to the spray means.

12. System for removing coating material accumulated on carriers depending from an overhead conveyor used to continuously move articles through a coating line including a zone for applying coating to the articles, said system comprising

means for burning accumulated coating material from said carriers thereby producing combustion product gas and leaving a solid residue,

means downstream of said burning means to impinge liquid on the carriers to remove the residue,

said burning means and said liquid impinging means each being associated with structure containing means defining a passageway having access from the top for movement of the carriers therethrough.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,830,196 Dated August 20, 1974

Inventor(s) Barney C. Guttman, William J. Suchy, Vincent J. Berardinelli

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The name of one of the inventors appearing in the patent should be changed from "Earney C. Guttman" to --Barney C. Guttman--.

At column 3, line 23, "fuelair" should be changed to --fuel-air--.

Signed and sealed this 10th day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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